



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/689,167

10/20/2003

Heinz H. Busta

100077

6389

29050

7590

02/06/2006

STEVEN WESEMAN
ASSOCIATE GENERAL COUNSEL, I.P.
CABOT MICROELECTRONICS CORPORATION
870 NORTH COMMONS DRIVE
AURORA, IL 60504

EXAMINER

FULK, STEVEN J

ART UNIT

PAPER NUMBER

2891

DATE MAILED: 02/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/689,167

Applicant(s)

BUSTA, HEINZ H.

Examiner

Steven J. Fulk

Art Unit

2891

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 January 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 and 10-57 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8 and 10-57 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 10/20/03.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☒ Other: Non-patent Literature.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 9, 2006 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 36 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 36 recites the limitation "said planarized surface". There is insufficient antecedent basis for a "planarized surface" in either claim 36, 33, 31, 30 or 29. Claim 36 should apparently depend on claim 35.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-4 and 10 are rejected under 35 U.S.C. 102(e) as being anticipated by Daneman et al. '887.

Daneman et al. discloses a MEM device comprising a movable micro-machined structure (fig. 9A, 911) and a conductive diamond material defining an abrasion resistive contact area (read as resistive to stiction, abstract) disposed along a surface of the structure (922-928; col. 11, lines 12-17); and the device operates as a relay switch with a lever mechanism (col. 4, lines 44-49) that is inherently subject to abrasion as it closes.

6. Claims 11, 13-19 and 27-28 are rejected under 35 U.S.C. 102(b) as being anticipated by De Los Santos et al. '611.

De Los Santos et al. discloses a MEM device comprising a moveable mechanism (fig. 2, 28) residing adjacent a substrate (22); an abrasion resistant material (read as a stiction resistant material; col. 1, lines 63-65) localized on a first portion of the movable mechanism (30b); a first contact region localized on the substrate that attracts the moveable mechanism toward the substrate (40b) such that the abrasion resistant material becomes operationally coupled to a second contact region (24b) comprising an abrasion resistive material that resides on the substrate, wherein the second contact material is similar to the first portion material; the second contact region comprising a first RF contact portion and a

second RF contact portion such that the movable mechanism shorts the first and second RF contacts (fig. 7, 24b; RF IN & OUT); a third contact region operable to pull back the moveable mechanism from being attracted to the second contact region (fig. 2, 38a); the moveable mechanism further comprising a first anchor portion (34) and a second anchor portion (32) integral to a top surface of the substrate, wherein the first anchor portion is a dielectric layer that prevents the lever mechanism from physically coupling to the third contact region when the first contact region is energized. It is inherent that the first portion of the mechanism would be subject to abrasion as the first portion of the mechanism becomes operationally coupled to the second contact region.

7. Claim 37 is rejected under 35 U.S.C. 102(b) as being anticipated by Huang et al. '353.

Huang et al. discloses a MEM device comprising a moveable mechanism (fig. 5, 134) residing adjacent a substrate (110); an abrasion resistant material (tungsten, for example; col. 2, lines 55-59) localized on a first portion of the movable mechanism (135); a first contact region (125) that attracts the moveable mechanism toward the substrate such that the abrasion resistant material becomes operationally coupled to a second contact (122); and further comprising an integral enclosure to enclose the MEM device (150).

8. Claims 39-40, 42-50 and 52-57 are rejected under 35 U.S.C. 102(b) as being anticipated by Tilmans et al. '072.

Tilmans et al. discloses an integral micro-machined structure for enclosing a MEM device and method of manufacture thereof (fig. 12), comprising providing a

Art Unit: 2891

substrate (121), fabricating a vertical structure extending from the substrate (switch in cavity area) and fabricating a cover over the substrate structure (122), wherein the cover defines a tortuous channel (labyrinth path, top down view, fig. 1) and covers a plurality of MEM devices (fig. 16, col. 6, lines 54-61), sacrificial material is removed through the channel (col. 7, lines 42-49), and a sealing member engaging the channel (123); and an inert (and thus arc preventing) gaseous material or vacuum sealed state inside the enclosure (col. 2, lines 1-8).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Daneman et al. '887 in view of Lin et al. (NPL Reference "U").

Daneman et al. discloses all of the elements of the claim as discussed above including a lever mechanism, but the reference does not explicitly teach the lever mechanism to have a rib enforced lever. Lin et al. teaches a moveable micro-machine switch structure using a rib enforced lever (fig. 1; page 93-95, section 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the rib enforced lever of Lin et al. in the switch mechanism of Daneman et al. One would have been motivated to do this because a rib enforced lever was known to increase the lever stiffness and prevent

deformation of the lever, improving the performance of the device (Lin et al., page 93, section 1).

11. Claim 6-8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Daneman et al. '887 in view of Huang et al. '353.

Daneman et al. discloses all of the elements of the claims including a micro-machined structure, but does not explicitly teach an integral enclosure having an aperture over the structure. Huang et al. teaches a micro-machined structure with an integral enclosure having an aperture over the structure (figs. 5-6).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the enclosure of Huang et al. in the structure of Daneman et al. One would have been motivated to do this because using an enclosure was a well known method of hermetically sealing a micro-machined structure to protect it from the environment, thus improving the performance of the device (Huang et al., col. 4, lines 31-33).

12. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Daneman et al. '887.

Los Santos et al. '611 discloses all of the elements of the claim as discusses above including an abrasion resistant material on a first portion of the moveable mechanism, but the reference does not explicitly teach the use of a diamond material as an abrasion resistant material. Daneman et al. teaches a MEM device comprising a movable mechanism with a diamond abrasion resistant material on a first portion of the moveable mechanism (fig. 9A; col. 11, lines 12-17).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the diamond material of Daneman et al. in the MEM device of Los Santos et al. One would have been motivated to do this because diamond was well known in the art to be extremely hard and abrasion resistant, and thus would have improved the performance of the device.

13. Insofar as definite, claims 20-23, 29-31, 34-36 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Lin et al. (NPL Reference "U"). The process limitations of planarization by chemical-mechanical polishing found in claims 22 and 23 invoke the product-by-process doctrine. Product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps (*MPEP* § 2113). For example, anticipation of claim 23 does not require the metallic layer to be processed using a CMP step.

a. Regarding claims 20-23, De Los Santos et al. teaches all of the elements of the claims including a moveable mechanism, but does not explicitly teach a second surface on the mechanism comprising a metallic rib. Lin et al. teaches a moveable micro-machine switch structure using a metallic rib enforced lever (page 95, section 3.1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the metallic rib enforced lever of Lin et al. in the switch mechanism of De Los Santos et al. One would have been motivated to do this because a rib enforced lever was known to increase the

lever stiffness and prevent deformation of the lever, improving the performance of the device (Lin et al., page 93, section 1).

b. Regarding claims 29-31, 34-36 and 38, De Los Santos et al. discloses a MEM switching device comprising a lever mechanism (fig. 2, 28) residing along a surface of a substrate (22) having an anchor mechanism (34/32) extending from the surface; a first contact region deposited on the substrate (38b) and capable of being energized to attract the lever toward the substrate, such that the lever becomes electrically coupled to a third contact (fig. 7, 24b, RF IN & OUT) that comprises a first and second micro-strip line; and a second contact region that pulls back the lever from being electrically coupled to a third contact region (38a).

De Los Santos et al. does not explicitly teach an integral conductive rib on the lever mechanism. Lin et al. teaches a moveable micro-machine switch structure using an integral conductive rib enforced lever (page 95, section 3.1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the integral conductive rib enforced lever of Lin et al. in the switch mechanism of De Los Santos et al. One would have been motivated to do this because a rib enforced lever was known to increase the lever stiffness and prevent deformation of the lever, improving the performance of the device (Lin et al., page 93, 3rd paragraph).

13. Claims 24-26 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Lin et al. (NPL Reference "U"), and further in view of Huang et al. '353.

a. Regarding claims 24-26, De Los Santos et al. in view of Lin et al. teaches all of the elements of the claims as discussed above including a pull-back contact, but does not explicitly teach an integral enclosure comprising an electrical shield. Huang et al. teaches a MEM switch device with an integral enclosure comprising an electrical shield (fig. 5, 150).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the enclosure of Huang et al. in the moveable mechanism device as described by De Los Santos et al. in view of Lin et al. One would have been motivated to do this because an enclosure with an electrical shield would prevent RF signal loss and protect the device from the environment, thus improving the device performance (Huang et al., col. 1, lines 46-52).

b. Regarding claim 32, De Los Santos et al. in view of Lin et al. teaches all of the elements of the claims as discussed above including a conductive rib enforced lever, but does not explicitly teach the conductive rib material to be copper. Huang et al. teaches a MEM switch device wherein the lever material is copper (fig. 5, 134; col. 3, lines 32-34).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the conductive copper material of Huang et al. in the rib enforced lever as described by De Los Santos et al. in view of

Lin et al. One would have been motivated to do this because copper metal was a well known material used in MEM switches due to its low thermal expansion coefficient, which would have allowed stable operation of the switch throughout temperature variations (Huang et al., col. 3, lines 32-34).

14. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Lin et al. (NPL Reference "U"), and further in view of Daneman et al. '887.

De Los Santos et al. in view of Lin et al. teaches all of the elements of the claims as discussed above including a conductive rib enforced lever, but does not explicitly teach the conductive rib material to be diamond. Daneman et al. '887 teaches a MEM switch device wherein the lever material comprises diamond (fig. 9A; col. 11, lines 12-17).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the conductive diamond material of Daneman et al. in the rib enforced lever as described by De Los Santos et al. in view of Lin et al. One would have been motivated to do this because diamond was well known in the art to be extremely hard and abrasion resistant, and thus would have improved the performance of the device.

15. Claims 41 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tilmans et al. '072 in view of De Los Santos et al. '611.

Tilmans et al. discloses all of the elements of the claims as discussed above including a micro-machined structure for enclosing a MEM device, but does not explicitly teach the structure to comprise a contact region acting as a pull-back

contact for a MEM device and acting as a shield for electromagnetic radiation. De Los Santos et al. teaches a micro-machined structure comprising a contact region acting as a pull-back contact for a MEM switch device (fig. 7, 38a; col. 41-47) and as a shield for electromagnetic radiation (metal/dielectric layer would inherently shield EM radiation; col. 5, 55-60).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the contact region of De Los Santos et al. in the micro-machined structure of Tilmans et al. One would have been motivated to do this because including a pull-back mechanism would have decreased the overall switching time of the device and an electromagnetic shield would have prevented signal loss, thus improving the performance of the device.

16. Claim 51 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tilmans et al. '072 in view of Daneman et al. '887.

Tilmans et al. discloses all of the elements of the claim as discussed above including a micro-machined structure for enclosing a MEM device, but does not explicitly disclose the MEM device to comprise diamond. Daneman et al. teaches a micro-machined structure wherein the device comprises diamond (fig. 9A; col. 11, lines 12-17).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the diamond material of Daneman et al. in the device of Tilmans et al. One would have been motivated to do this because diamond was well known in the art to be extremely hard and abrasion resistant, and thus would have improved the performance of the device.

Conclusion

17. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ruan et al. '212 discloses a micro-machined switch having a cantilever beam, a contact to electrically attract the beam to a substrate, and an enclosure surrounding the beam.

Krauss et al. '601 discloses a micro-machined cantilever sensor comprising diamond material in the beam.

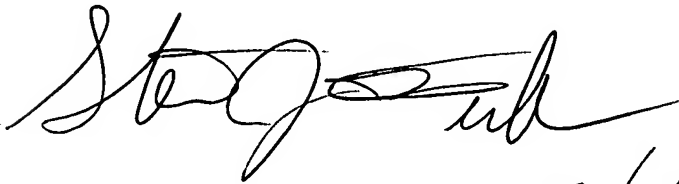
Chan et al. '296, Reid 172, Bifano '635, and Kaiser et al. '195 disclose MEM switch devices comprising a cantilever beam and a contact to electrically attract the beam to a substrate.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven J. Fulk whose telephone number is (571) 272-8323. The examiner can normally be reached on Monday through Friday, 9:00am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

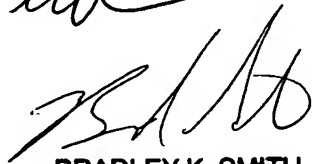
Art Unit: 2891

19. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Steven J. Fulk
Patent Examiner
Art Unit 2891

January 31, 2006


BRADLEY K. SMITH
PRIMARY EXAMINER